PATENT SPECIFICATION 1,124,311

DRAWINGS ATTACHED.

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1,124,311

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COMPLETE SPECIFICATION.

Improvements in Anode Assemblies.

We, CORROSION & WELDING ENGINEERING LIMITED, a Company registered under the laws of Great Britain of Kingston Road, Leatherhead in the County of Surrey, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to anode assemblies for use in impressed current electrolytic protection systems.

Such systems are frequently used to protect ships' hulls from the corrosive action of sea water but hitherto they have been expensive to manufacture and have necessitated considerable on-site work to attach the assemblies to the hull. Moreover in order to assist in the spread of the protective current the hull has frequently been treated in the region to which the anode is to be attached by coating it with an electrically non-conductive material.

It is one object of this invention to provide an improved anode assembly.

It is a further object of this invention to provide an improved method of manufacturing an anode assembly.

According to one aspect of the present invention there is provided an anode assembly for use in an impressed current electrolytic protection system for protecting a metallic structure comprising a backing plate which is capable of being welded to the structure and an elongated anode mounted on the backing plate and electrically insulated therefrom by means of a plastics material.

According to a further aspect of this invention there is provided a method of manufacturing an anode assembly according to this invention comprising stressing the anode and the backing plate in the same juxta-position as in the finished assembly to be curved longitudinally with a radius of curvature less than that part of the surface of the structure to which the assembly is to be secured and forming a bed of plastics material to support the anode on the backing plate in said juxta-position thereto and to insulate it from the backing plate.

The above and other aspects of the invention will now be described, by way of example, with reference to the accompanying drawing:—

Fig. 1 is a plan view of one anode assembly which is suitable for use in an electrolytic protection system for protecting a ship's hull,

Figs. 2, 3 and 4 are enlarged sectional views on the lines II—II, III—III and IV—IV of Fig. 1,

Fig. 5 is a sectional view of an electrical connection for the current supply to the anode,

Fig. 6 is a plan view of another anode assembly which is also suitable for use in an electrolytic protection system for protecting a ship's hull, and

Fig. 7 is an enlarged cross-sectional view on the line VII—VII of Fig. 6.

The anode assembly shown in Figs. 1 and 2 comprises an elongated anode 1 (that is an anode have a length greater than its other dimensions) embedded along its whole length in a bed 2 of a suitably hard epoxy resin and carried on a mild steel support plate 3 which is turned back at its ends 4. The support plate 3 carrying the anode 1 in its resin bed 2 is mounted on a backing plate 5 formed of a heavier gauge mild steel by means of threaded bolts 6 secured by

[*Price* 4*s.* 6*d.*]

nuts and the whole assembly is positioned on the ship's hull (not shown) by means of a pair of studs 7.

The anode 1 comprises a longitudinally extended titanium bar of square or rectangular cross-section having one longitudinal face platinised and is embedded in the resin 2 with only its upper platinised face exposed. Current is supplied to the anode 1 via a solid filled cable 9 introduced to the anode through a fairing shoe 10.

The backing plate 5 is coated over its surface with a shielding layer of epoxy coal tar resin 11 to assist in the spread of the protective current. So that the backing plate 5 may be welded to the structure a narrow marginal zone 12 at the periphery thereof is left uncoated with resin.

Referring to Fig. 3 the support plate 3 carrying the anode embedded in resin is secured to the backing plate 5 by means of the bolts 6 each of which is countersunk therein and passes through apertures in the plates 3 and 5 to engage a nut 13 embedded in the resin. Referring to Fig. 4 the whole assembly is positioned on the ship's hull by means of the pair of studs 7 each of which is welded to a plate 14 of the hull and has a disc-like base 15 engaging an aperture formed in the backing plate 5 to receive it and also has a threaded shank 16 passing through an aperture in the support plate 3 to be secured by a nut 17 and a fan washer 18.

One end of the support 3 and the bottom edge of the fairing shoe are welded to the backing plate 5 to provide a rigid assembly and the whole anode assembly is secured to the hull by means of a fillet weld extending continuously around the whole edge of the backing plate 5.

Fig. 5 shows the eletcrical connection between the cable 9 and the anode 1. This connection is effected by means of a brass connector 19 having a socket 20 into which the cable core is sweated and a threaded shank 21 projecting coaxially with the socket 20 which is screwed into a second socket formed in one end of the anode 1. The whole construction is embedded in the bed 2 and this effectively seals the connection against the ingress of water which, especially if it were sea water, would be highly corrosive.

The anode assembly is secured to a ship's hull by firstly welding the studs 7 in position on the hull, clamping the assembly over the studs 7 by screwing up the nuts 17 and then running the previously referred to fillet weld around the edge of the backing plate 5.

The anode assembly shown in Figs. 6 and 7 also comprises a platinised titanium anode 1, a resin bed 2 and a backing plate 5. The backing plate 5 is formed with a longitudinally extending raised central portion defined by two wings 22 formed from the plate 5 and subtending between them an angle of ninety degrees. The space between the ends of the wings 22 is bridged by end-plates 23. The bed 2 consists of polyester resin reinforced wih laminations of fibre glass, and is formed in the dish-shaped space defined between the wings 22 and the end-plates 23 to present smooth, flat upper and lower surfaces, the lower surface being continuous with the underside of the backing plate 5. A layer of the resin/fibre glass bed is extended over most of the exposed surface of the backing plate 5 to provide the shield 11. The anode 1 is embedded in the resin/fibre glass bed 2 so that only the platinised face 8 is exposed. The anode is provided with feet 24 welded to its underside at intervals along its length to key into the bed 2. These feet are of the same metal as the anode—in the present example, titanium. Bracing-bars or spacers 25 are secured at intervals along the underside of the backing plate 5 across the space between the wings 22. Current is introduced through a solid filled cable 9 partially embedded in the bed 2 and the core of which is welded to one of the flange plates 24. A jumper cable or cables 26 may be used to provide electrical connection between the flanges. The cable connections are cast in the resin/fibre glass bed thereby providing a sealed and watertight joint.

As in the embodiment shown in Figs. 1 to 5 the assembly of this embodiment is secured to the hull of a ship by means of a continuous fillet weld running around the edge of the backing plate. Prior to attaching the assembly, the ship's hull is bored and a cofferdam is fitted to receive the cable 9.

The anode assembly of this second embodiment is manufactured by the following method.

The anode 1 together with its feet 24 and the various cable connections is mounted in a slotted jig which stresses the anode into a predetermined minimum-type curve in a vertical plane. The radius of curvature of this curve is chosen to be somewhat less than that of the surface to which it is to be secured. The backing plate 5 which is preformed into its final shape together with the wings 22 and the end pieces 23 is inverted and mounted on the same or a further jig with the same curve as the anode and in the same juxtaposition thereto as in the finished article. The bed 2 is then built up by applying alternate laminations of fibre glass and polyester resin from above into the trough defined by the backing plate, the anode and the jig to form the bed 2. The spacer 25 may be secured in position either before or during this process. The bed is then cured with the assembly held in the jig

and after curing the assembly is removed from the jig, inverted and a fibre glass layer together with a brush coating of resin are applied to the now upper surface of the backing plate 5 and cured to form the shield 11.

The step of precurving the anode and backing plate mitigates or overcomes two disadvantages which would otherwise occur and give rise to cracking and thence weakening of the bed 2. Firstly the resin/ fibre glass mixture contracts on curing and this produces tensional stresses in the bed when the assembly is secured to the structure. Secondly further tensional stresses are produced when the assembly is secured to a convex surface such as a ship's hull. The curvature to which the anode and the backing-plate are stressed is therefore chosen to take both these factors into account.

If desired the anode 2 may be provided with a copper core to strengthen it and to reduce its electrical resistance. In this case the cable 9 would be connected to the core.

The anode could be formed of high purity zinc and the assembly used as a reference electrode half cell.

WHAT WE CLAIM IS:—

1. An anode asembly for use in an impressed current electrolytic protection system for protecting a metallic structure comprising a backing plate which is capable of being welded to the structure and an elongated anode mounted on the backing plate and electrically insulated therefrom by means of a plastics material.

2. An assembly according to claim 1 wherein the backing plate is coated on one face with a shielding layer of electrically non-conducting material extending around the anode and laterally away therefrom so as to effect spreading of the protective current when the assembly is in use.

3. An assembly according to claim 2 wherein there is a marginal zone extending around the periphery of said face of the backing plate over which the shield does not extend.

4. An assembly according to any preceding claim including a support plate secured to the backing plate and carrying a bed of the plastics material by means of which the anode is mounted.

5. An assembly according to claim 4 wherein the support plate is secured to the backing plate by welding and by bolts or studs passing through apertures in each plate and secured by nuts embedded in the bed.

6. An assembly according to claim 4 or 5 comprising one or more threaded positioning studs and associated securing nuts each having a base to be secured to the structure and a threaded shank wherein for each stud the backing plate is apertured to receive the shank and the nut.

7. An assembly according to any one of claims 1 to 3 wherein the backing plate is formed with a pair of longitudinally extending wings upstanding therefrom and defining between them a space in which the plastics material is situated.

8. An assembly according to claim 7 including bars secured at intervals along the underside of the backing plate across the space between the wings.

9. An assembly according to any preceding claim wherein the anode comprises a metallic bar of constant cross-section.

10. An asembly according to claim 9 wherein the anode is provided with feet or flanges to key it to the plastics material.

11. An assembly according to any preceding claim wherein the anode is of titanium.

12. An assembly according to claims 9 and 11 wherein only one face of the anode is exposed from the plastics material and that face is platinised.

13. An assembly according to any one of claims 1 to 10 wherein the anode is of zinc.

14. An assembly according to any preceding claim comprising a cable connected to the anode wherein the connection is embedded in the plastics material.

15. An assembly according to any preceding claim wherein the plastics material is an epoxy resin.

16. An asembly according to any preceding claim wherein the plastics material is a polyester resin reinforced with fibre glass.

17. A method of manufacturing an anode assembly according to any preceding claim comprising stressing the anode and the backing plate in the same juxta-position as in the finished assembly to be curved longitudinally with a radius of curvature less than that part of the surface of the structure to which the assembly is to be secured and forming a bed of plastics material to support the anode on the backing plate in said juxta-position thereto and to insulate it from the backing plate.

18. A method according to claim 17 wherein the anode assembly is in accordance with the claim 8 and the bed is formed by applying the plastics material in an uncured and readily workable state through said aperture and subsequently curing it.

19. A method of manufacturing an anode assembly substantially as herein described.

20. A metallic structure provided with an anode assembly according to any one of claims 1 to 16.

21. A metallic structure according to claim 20 in which the backing plate is welded to the structure.

22. A ship's hull provided with an anode assembly according to any one of claims 1 to 16.

23. An anode asembly substantially as herein described with reference to Figs. 1 to 5 or Figs. 6 and 7 of the accompanying drawings.

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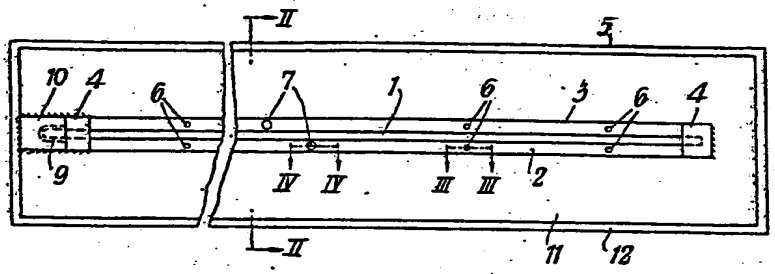


FIG.1

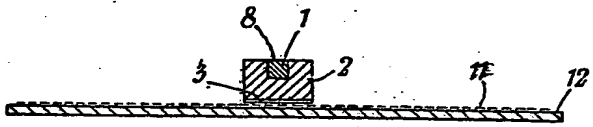


FIG.2

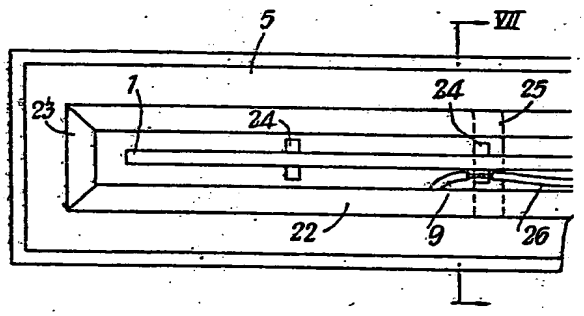
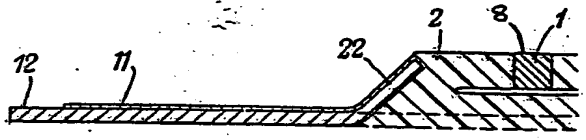


FIG.



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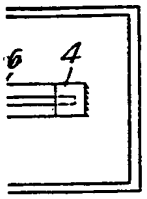

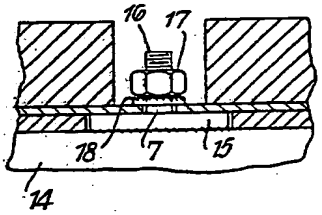

FIG.4

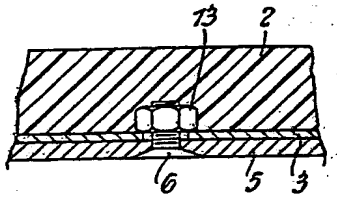

FIG.3

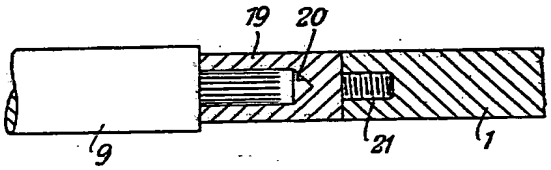

FIG.5

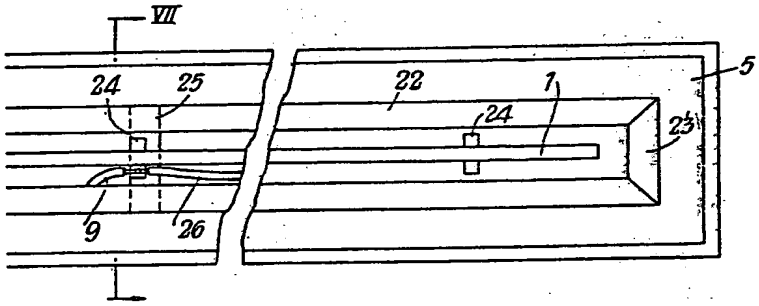

FIG.6

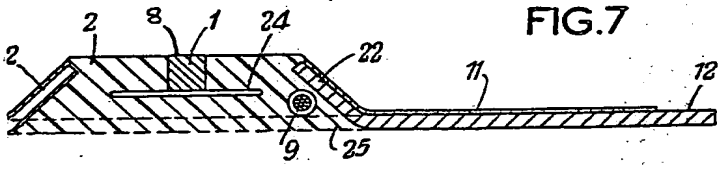

FIG.7

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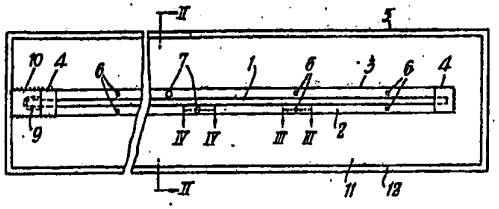

FIG.1

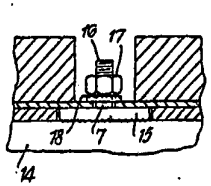

FIG.4

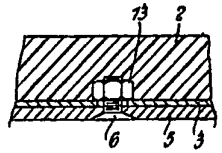

FIG.3

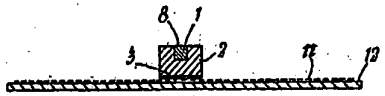

FIG.2

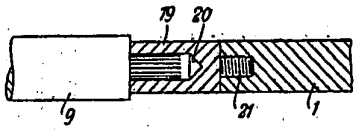

FIG.5

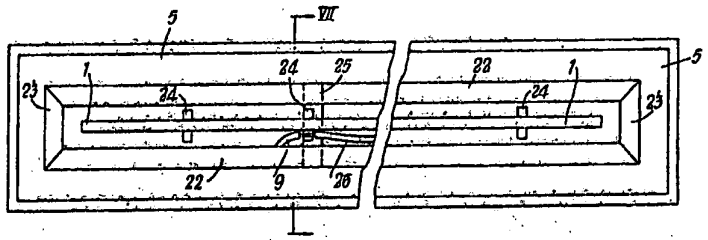

FIG.6

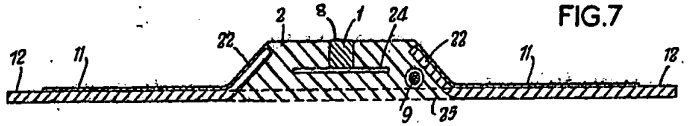

FIG.7